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THE EFFECTS OF FLEET BALLISTIC MISSILE SUBMARINE PATROLS  
ON ORAL HEALTH

by

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and  
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Bureau of Medicine and Surgery, Navy Department  
Research Work Unit MR005.20.01-6024B.11

Released by:

J. E. Stark, CAPT MC USN  
COMMANDING OFFICER  
Naval Submarine Medical Center

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SUBMARINE MEDICAL RESEARCH LABORATORY  
NAVAL SUBMARINE MEDICAL CENTER REPORT NO. 640

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## SUMMARY PAGE

### THE PROBLEM

Some past diary reports have indicated a special problem with gingivitis in submarines on patrol. Some recent reports have presented data to the contrary. In view of the extreme importance of maintaining the highest possible health level in FBM submarines, additional longitudinal data were required.

### FINDINGS

Patrol effects on gingivitis could not be demonstrated in this study of ninety-one crew members of the USS JOHN MARSHALL (SSBN 611 (Gold)). Significant positive relationships were found between personal oral hygiene and gingival health. This corroborates former studies from this laboratory.

### APPLICATIONS

While patrol effects on gingival health were not demonstrated, the concomitant demonstration of the importance of personal oral hygiene exposes the need for more effort in the field of bacterial plaque control in order to maintain a high level of oral health in submariners.

### ADMINISTRATIVE INFORMATION

This investigation was conducted as a part of Bureau of Medicine and Surgery Research Work Unit MR005.20.01-6024B - Effect of Stresses of Submarine Service on Oral Health. This report has been designated as Submarine Medical Research Laboratory Report No. 640. It is Report No. 11 on this Work Unit and was approved for publication as of 26 August 1970.

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## ABSTRACT

Maintenance of optimum oral health for Fleet Ballistic Missile submarine personnel is a continuing effort. Information is required concerning oral health status and patrol effects on this status. Ninety-one crew members of the USS JOHN MARSHALL (SSBN 611 (Gold)) were evaluated predeployment, during the first week of patrol, and during the seventh week of patrol for gingivitis (gum diseases) and personal oral hygiene habits. No detrimental patrol effects were observed. A close relationship was noted between gingival (gum) health and good hygiene practices. It is concluded that efforts to improve hygiene practices of submariners should be continued and strengthened.

# THE EFFECTS OF FLEET BALLISTIC MISSILE SUBMARINE PATROLS ON ORAL HEALTH

## INTRODUCTION

The occurrence of dental problems in isolated crews on submarines and in other environments has long been a matter of concern to the military dentist. Diary type reports have indicated severe oral problems to be associated with these environments and conjectures based on laboratory studies have consistently pointed to the need for good hard longitudinal data on the oral health of such isolated crew members.

Studies by Powers and Shiller<sup>1</sup> and Kropp and Shiller<sup>2</sup> have already yielded data which indicated that no deleterious effects on oral soft tissue results from Fleet Ballistic Missile (FBM) submarine patrols by the crews of two boats. The World War II study by Van Der Aue and Cullen<sup>3</sup> certainly demonstrates however, that great differences can exist between individual submarine crews. In view of the extreme importance of oral health of FBM crews, it was felt advisable to do a careful longitudinal study in one additional submarine crew.

## MATERIALS AND METHODS

Ninety-one volunteers from the USS JOHN MARSHALL (SSBN 611, Gold Crew) were subjects for the study. The measurements consisted of a plaque score computed by the method of Greene and Vermillion<sup>4</sup> and a periodontal index modified from the method of Russell<sup>5</sup>. The modification consisted of ignoring periodontal pockets because of the short term nature of this study.

The senior author, who was the crew's medical officer, was instructed in the use of the indices by the staff of the Dental Branch of the Submarine Medical Research Laboratory.

The measurements were performed at Groton, Connecticut, just prior to deployment for patrol, during the first week of patrol, and during the seventh week of patrol.

These examinations were approximately equally spaced with regard to time intervals; being about six weeks apart. A questionnaire was administered at the time of the first two examinations to evaluate personal habits.

## RESULTS

The patrol effects on oral health are depicted in Table 1. It is seen that the mean periodontal indices show some variations; however, none of these differences are significant. The plaque scores remained essentially the same for the first two examination periods and then were reduced sharply near the end of the patrol. Based on the *t* test, this last mean was significantly lower than the other two plaque means ( $P < .001$ ).

The relationship between reported brushing habits and the periodontal indices is given in Table 2. The men who brushed less than once a day had much higher periodontal indices than did those who brushed more often. A high variance and a small number of subjects

Table 1

## Longitudinal Expression of Periodontal Index and Plaque Scores

Assessment periods	N	Periodontal Index	Plaque Scores
Predeployment	91	0.17* $\pm$ 0.030**	0.555 $\pm$ 0.068
First week of patrol	91	0.14 $\pm$ 0.025	0.550 $\pm$ 0.066
Seventh week of patrol	91	0.15 $\pm$ 0.033	0.269 $\pm$ 0.041

\*Mean

\*\*Standard error of the mean.

Table 2

Relationship Between Reported Toothbrushing  
and Periodontal Index

Toothbrushing Frequency	N	Periodontal Index
Less than once a day	11	0.41* $\pm$ 0.174**
At least once a day	23	0.11 $\pm$ 0.028
Twice a day	36	0.11 $\pm$ 0.020
Three or more times a day	14	0.11 $\pm$ 0.020

\*Mean

\*\*Standard error of the mean.

preclude assignment of statistical significance to these differences ( $P > .05$ ).

Table 3 depicts the relationship between reported toothbrushing and the plaque scores. It is apparent that a direct relationship exists. The analy-

sis of variance was employed to test for significance of group differences:

$$\text{where } F = \frac{\text{between group mean squares}}{\text{within group mean squares}}$$

The computed value of F indicates highly significant group differences ( $P < .01$ ).

Table 3

Relationship Between Reported Toothbrushing Frequency  
and Plaque Scores

Toothbrushing Frequency	N	Plaque Scores
Less than once a day	11	1.166* $\pm$ 0.328**
At least once a day	23	0.580 $\pm$ 0.128
Twice a day	36	0.491 $\pm$ 0.075
Three or more times a day	14	0.226 $\pm$ 0.060

\*Mean

\*\*Standard error of the mean.

ANOVA F = 5.51 P < .01

Each man was asked to evaluate how well he followed toothbrushing instructions. The results are given in Table 4. It is apparent that no significant differences in plaque scores were found between the three responses.

The reported frequency of toothbrushing was recorded prior to deployment and during the first week of patrol. The data are presented in Table 5, so that an idea of changes in brushing frequency may be observed. It is recognized that a diagonal line through the center of the table represents the value of no change, and the values above this line represent increased brushing frequency while values below the line represent decreased frequencies. Nineteen subjects reported an increased frequency of brushing on patrol; 11 reported decreased frequency; and 52 reported no change.

The average age of the subjects was  $26.1 \pm .60$  (SEM) with a range from 19 - 45. Over one-half of the subjects were 25 or under and only 18 were over 30. The relationships between age and periodontal indices are presented in Table 6. In general, age was directly related to periodontal index; however, the 25 - 29 age group had the lowest scores. These mean differences were not statistically significant. It should be remembered that inflammation only was scored in this study. The advanced degenerative periodontal lesions usually associated with age in a population study were not a part of the examination criteria.

The subjects were about equally distributed between non-smokers, light smokers, and moderate to heavy smokers. The relationship between smoking

Table 4

"How well do you follow brushing instructions?"  
Related to Plaque Scores.

Response	N	Plaque Scores
Follow instructions closely	39	0.573* $\pm$ 0.116**
Try to follow instructions but find them difficult	37	0.536 $\pm$ 0.093
Gave up trying to follow instructions	10	0.667 $\pm$ 0.218

\*Mean

\*\*Standard error of the mean.

Table 5

Toothbrushing Changes with a Fleet Ballistic Missile (FBM) Patrol

Predeployment brushing	First week of patrol brushing				
	Seldom	Usually once a day	At least once a day	Twice a day	3 or more times a day
Seldom	1	1			
Usually once a day	1	5	5	1	
At least once a day	1	2	12	8	
Twice a day			5	24	4
Three or more times a day				2	10



Table 6

Relationship Between Age  
and Periodontal Index

Age Group	N	Periodontal Index
19 - 24	48	0.15* $\pm$ 0.025**
25 - 29	25	0.11 $\pm$ 0.031
30 and over	18	0.31 $\pm$ 0.125

\*Mean

\*\*Standard error of the mean.

and periodontal inflammation is given in Table 7. The only significant difference was found between non-smokers and smokers. No relationship seemed to exist between the periodontal index and the amount smoked.

#### DISCUSSION

The importance of the Fleet Ballistic Missile system dictated a great concern by the Navy Dental Corps over the possible presence of environmental factors leading to increased incidences of dental disease. The results of this study corroborate the longitudinal findings of Powers and Shiller<sup>1</sup>, Kropp and Shiller<sup>2</sup>, and the cross-sectional findings of Shiller<sup>6,7</sup>. The interpretation of these collective findings would seem to indicate that the environment per se has not led to an oral health problem.

Table 7

Relationship Between Smoking  
and Periodontal Index

Smoking Habit	N	Periodontal Index
Doesn't smoke	30	0.10* $\pm$ 0.018**
Light smoker (less than one pack/day)	22	0.20 $\pm$ 0.038
Smokes one pack - or more/day	32	0.17 $\pm$ 0.064

\*Mean

\*\*Standard error of the mean.

If one ended the discussion at this point a great truth might be overlooked. The present study and those cited above found a close relationship between personal hygiene practices and oral disease. This was also clearly true in Van Der Aue and Cullen's<sup>3</sup> World War II submariner study. Keeping this fact in mind, and still being aware of the importance of the FBM submariner, the need for a continuing research program in this area is certainly indicated. Such a program should lean heavily on means for improving personal hygiene practices. It should also include a continuing monitoring of the biological factors at work, especially with regard to fine analyses of the oral bacterial population; since, from the data at hand, these plaque bacteria are obviously the agents of importance in the oral diseases found, but have only been studied in a longitudinal manner for one crew during one patrol<sup>8</sup>.

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